Chapter 24 Spinal Trauma

Introduction to Spinal Injuries (1 of 2)

- Annually 15,000 permanent spinal cord injuries
- Commonly men 16-30 years old

Mechanism of Injury:

- Vehicle crashes: 48%
- ______________ : 21%
- ______________ trauma: 15%
- ______________ injury: 14%

Introduction to Spinal Injuries (2 of 2)

- 25% of all spinal cord injuries occur from ______________ , based upon MOI, that patient's have a spinal injury.

- Manage ALL spinal injuries with immediate and ______________ care

- Lifelong care for spinal cord injury victim exceeds $1 million.

- Best form of care is public safety and ______________ programs.

Spinal Anatomy and Physiology: Vertebral Column (1 of 2)

- ___________ bones comprise the spine.

Function

- Skeletal support structure
- Major portion of axial skeleton

- ______________ container for spinal cord

Vertebral body

- Major ______________ -bearing component
- Anterior to other vertebrae components

Spinal Anatomy and Physiology: Vertebral Column (2 of 2)

Cervical Spine (1 of 2)

- ___________ vertebrae

- Sole support for head
  - Head weighs 16–22 pounds

- C-1 (atlas)
  - Supports ______________
  - Securely affixed to the occiput
  - Permits ______________

Cervical Spine (2 of 2)

- C-2 (axis)
  - Odontoid process (dens)
    - Projects ______________
    - Provides ______________ point so head can rotate

- C-7
  - ______________ spinous process (vertebra prominens)
8  **Thoracic Spine (2 of 2)**
   - __________ vertebrae
   - 1st rib articulates with ____________________________
     - Attaches to transverse process and vertebral body
   - Next nine ribs attach to the ____________________________ and superior portion of adjacent vertebral bodies
     - ____________________________ rib movement and provides increased rigidity

9  **Thoracic Spine (2 of 2)**
   - Larger and ____________________________ than cervical spine
     - Larger muscles help to ensure that the body stays erect
     - Supports ____________________________ of the thoracic cage during respirations

10 **Lumbar Spine**
   - __________ vertebrae
     - Bear forces of ____________________________ and lifting above the pelvis
     - ____________________________ and thickest vertebral bodies and intervertebral disks

11 **Sacral Spine**
   - __________ fused vertebrae
     - Form posterior plate of ____________________________
     - Help protect urinary and reproductive organs
     - Attach pelvis and lower extremities to ____________________________ skeleton

12 **Coccygeal Spine**
   - __________ fused vertebrae
     - Residual elements of a ____________________________

13 **Spinal Cord**
   - Transmits ____________________________ input from body to brain through 31 pairs of nerves
     - Conducts motor impulses from brain to muscles and organs
     - Protected by 3 layers of meninges
       - ____________________________ Mater
       - ____________________________ Mater
       - ____________________________

14 **Mechanisms of Spinal Injury (1 of 3)**
   **Extremes of Motion:**
   - ____________________________
     - Hyperflexion: “Kiss the Chest”
     - Excessive ____________________________ bending

15 **Mechanisms of Spinal Injury (2 of 3)**
   **Axial Stress:**
   - ____________________________ Loading: compression of spine
     - Falls, lifting too much weight
- Compression common between T-12 and L-2
  - Opposite of axial loading: stretching of the spine
  - Hangings, __________________________ injuries
  - Combination
    - Distraction/Rotation or Compression/Flexion

16  Mechanisms of Spinal Injury (3 of 3)

Other MOI:
- Direct
- __________________________ trauma
- __________________________

17  Mechanisms Causing Spinal Injury

18  Column Injury (1 of 2)

- Movement of vertebrae from normal position
- __________________________ (incomplete dislocation) or Dislocation
- Fractures
  - Spinous process and __________________________ process
  - Vertebral __________________________
- Ruptured intervertebral __________________________

19  Column Injury (2 of 2)

Common sites of injury:
- C-1/C-2: __________________________ vertebrae
- C-7: Transition from flexible cervical spine to __________________________
- T-12/L-1: Different __________________________ between thoracic and lumbar regions

20  Cord Injury (1 of 4)

Concussion:
- Similar to cerebral concussion
- __________________________ and transient disruption of cord function

Contusion:
- __________________________ of the cord
- Tissue damage, vascular leakage and __________________________

21  Cord Injury (2 of 4)

Compression Injury:
- Secondary to:
  - displacement of the vertebrae
  - __________________________ of intervertebral disk
  - Displacement of vertebral bone __________________________
  - __________________________ from adjacent tissue

22  Cord Injury (3 of 4)

Laceration:
- Causes
  - Bony __________________________ driven into the vertebral foramen
- Cord may be __________________________ to the point of tearing
- Hemorrhage into cord tissue, swelling and disruption of
- Hemorrhage is also associated with contusion, laceration, or stretching

23 **Cord Injury (4 of 4)**
Transection Cord Injury:
- Injury that partially or completely __________________________ the spinal cord
- S/S depends on __________________________ of transection

24 **Complete Transection**
- Cervical Spine:
  - __________________________
  - Incontinence
  - Respiratory __________________________
- Below T-1
  - Incontinence
  - __________________________

25 **Points of Paralysis**

26 **Incomplete Transection Cord Injury (1 of 2)**
- __________________________ Cord Syndrome
  - Anterior vascular disruption
  - Loss of motor function and sensation of pain, light touch, & temperature below injury site
  - Retain motor, positional and vibration sensation
  - __________________________ injury
- __________________________ Cord Syndrome
  - Hyperextension of cervical spine
  - Motor weakness affecting upper extremities
  - __________________________ dysfunction

27 **Incomplete Transection Cord Injury (2 of 2)**
- Brown-Sequard’s Syndrome
  - Penetrating injury that affects __________________________ side of the cord
  - __________________________ (injured side) sensory and motor loss
  - __________________________ (opposite side) pain and temperature sensation loss

28 **General S/S of Spinal Injury**
- Extremity __________________________
- Pain with & without movement
- Tenderness along spine
- Impaired breathing
- Spinal __________________________ (rare)
- __________________________
- __________________________
- Loss of bowel or bladder control
- Nerve impairment to extremities
Spinal Shock (1 of 2)
Spinal shock is a temporary form of __________________________ shock that presents with hypotension, __________________________, and the signs and symptoms of cord injury.

Spinal Shock (2 of 2)
- __________________________ insult to the cord
- Affects body below the level of injury
- Affected area may be:
  - Without feeling
  - Loss of movement (______________________________ paralysis)
  - Frequent loss of bowel & bladder control
  - Priapism
  - Hypotension secondary to __________________________

Neurogenic Shock (1 of 2)
- Spinal-Vascular Shock
  - Occurs when injury to the spinal cord disrupts the brain's ability to control the body
  - Loss of __________________________ tone
  - Dilation of arteries and veins which:
    - __________________________ vascular space
    - Results in relative hypotension
    - Reduced cardiac __________________________
    - Reduction of the strength of contraction

Neurogenic Shock (2 of 2)
- Autonomic Nervous System (ANS) loses sympathetic control over adrenal medulla
  - Unable to control release of __________________________ & norepinephrine
    - Thus warm dry __________________________
  - Could depress __________________________

S/S of Neurogenic Shock
- __________________________
- __________________________
- Cool, Moist & Pale skin above the injury
- Warm, Dry & Flushed skin __________________________ the injury
- Priapism in males

Other Causes of Neurologic Dysfunction
- Any injury that affects the nerve impulse's path of travel
  - __________________________
  - Dislocations
  - __________________________ syndrome

Assessment of the Spinal Injury Patient
- Scene Size-Up
  - Put special emphasis on your analysis of the mechanism of injury with a potential spinal injury patient.
Determine ____________________________ of spinal trauma
Maintain suspicion with ______________________________ injuries
If unclear about MOI take spinal precautions

Primary Assessment (1 of 2)
- ABC’s
- Immobilize spine as needed
- Consider Oral or ____________________________ Intubation if required
  - Maintain in-line ____________________________ c-spine control

Primary Assessment (2 of 2)
- Control C-spine
  - ____________________________ injury
  - Intoxicated patients
  - All ____________________________ to the torso
- Maintain manual stabilization
  - Vest style versus rapid extrication
  - Maintain ____________________________ alignment
  - Increase of pain or resistance, restrict movement in position found

Rapid Trauma Assessment (Scan)
Perform a RTA on all patients with:
- Suspected or likely spinal cord/column injury
- Multi-system trauma patient
- Evaluate for:
  - Neck Deformity, Pain, Crepitus, ____________________________, Tenderness
  - Bilateral Extremities: Push, Pull, Grips
  - Motor & Sensory Function
  - ____________________________ Sign Test

Babinski’s Sign Test
- Stroke ____________________________ aspect of the bottom of the foot
- Evaluate for movement of the toes
  - ____________________________ of the toes and lifting of the great toe is a positive sign
- Indicates injury along the pyramidal (descending spinal) tract
- Positive Babinski’s sign is normal in patients under ____________ years of age
- May be permanent or ____________________________

Vital Signs and Reassessment
Vital Signs:
- Body ____________________________
- Pulse, BP, Respirations
Reassessment:
- Recheck elements of initial assessment
- Recheck vital signs
- Recheck ____________________________
- Recheck any ____________________________ deviations

Spinal Clearance
Some services have protocols to “______________________________” the spine, thus requiring no spinal immobilization. Controversial but growing in popularity. Follow local _______________________________ Never “clear” spine without protocols – Immobilize based on _______________________________

**Sample Spinal Clearance Protocol**

**Management of Spinal Injuries**

**Spinal Alignment**
- Move patient to a _______________________________ in-line position
  - Position of function
  - Hips and knees should be slightly _______________________________ for maximum comfort and minimum stress on muscles, joints, & spine if possible
- Place a rolled blanket under the knees
- ALWAYS support the _______________________________ and neck

**Contraindications to Neutral Position**
- Movement causes a noticeable increase in _______________________________
- Noticeable _______________________________ met during procedure
- Increase in neurological deficits occurs during movement
- Gross _______________________________ of spine

LESS MOVEMENT IS BEST!

**Manual Cervical Immobilization of Seated Patient**
- Approach from _______________________________
- Assign a care giver to hold GENTLE manual _______________________________
  - Reduce _______________________________ loading
  - Evaluate posterior cervical spine
- Position patient’s head slowly to a neutral, in-line position

**Manual Cervical Immobilization of Supine Patient**
- Assign a care giver to hold _______________________________ manual traction
  - Adult
    - Pad head off ground 1-2” if needed to assure neutral, in-line position
  - Child
    - Position head at ground level: Avoid flexion. _______________________________ under upper shoulders

**Pad as Needed**

**C-Collar Application**
- Apply the _______________________________ as soon as possible
- Assess neck prior to placing
- C-Collar limits some movement and reduces axial loading
- DOES _______________________________ completely prevent movement of the neck
- Size and apply according to the manufacturer’s recommendation
- Do NOT release manual control until the patient is fully secured in a spinal _______________________________ device
Standing Takedown (1 of 2)
- Minimum _____________ rescuers
- Have patient remain immobile
- Rescuer provides manual stabilization from ________________________________
  neck
- Size and place c-collar

Standing Takedown (2 of 2)
- Position board ________________________________ patient
- Grasp board under patient’s ________________________________
- Lower board to ground
- Secure patient
  ________________________________________________________________ WITH PARTNERS AND PATIENT!!

Helmet Removal

Remove Helmet if: (1 of 2)
- Helmet does not immobilize the patient’s head within
  - Fits too ________________________________
- Cannot securely immobilize the helmet to the long spine board
- Helmet prevents ________________________________ care
  - remove mask only if football helmet

Remove Helmet if: (2 of 2)
- Helmet prevents assessment of anticipated injuries
  - ________________________________, burns, etc
- Present or anticipated airway or ________________________________ problems
- Removal will not cause further ________________________________
- If helmet is removed, remove ________________________________ pads as well to maintain alignment

Helmet Removal Technique
- 2 Rescuers
- Remove face mask and ________________________________ strap
- Immobilize head
- Slide one hand under back of ________________________________ and head
- Other hand supports anterior neck and jaw
- 2nd rescuer removes helmet
- TRANSPORT ________________________________ and any other safety device (HANS) with patient
  ________________________________ is the KEY

Helmet removal may be a tricky endeavor. You should familiarize yourself with the types of ________________________________ used by sporting teams and venues in your area.

Movement of the Spinal Injury Patient
- Any movement MUST be ________________________________
- Move patient as a unit
- NO ________________________________ PUSHING
  - Move patient up and down to prevent lateral bending
● Rescuer at the head “CALLS” all moves
● ALL MOVES MUST be slowly executed and well coordinated
● Consider the ___________________________ positioning of the patient prior to beginning move

59 Types of Moves
● Log Roll
● ___________________________ Slide
● Rope-Sling Slide
● Orthopedic Stretcher
● Vest-Type Immobilization
● Rapid ___________________________
● Long Spine Board
● Diving/Swimming Injury Immobilization
  - In the ___________________________

60 During all movement of a spinal injury patient, keep the spine in the neutral, in-line position by keeping the patient’s eyes facing directly
  ___________________________ , and the shoulders, pelvis, and toes in the same ___________________________.

61 Transport Considerations
● Make sure patient is fully immobilized ___________________________ transporting
● ___________________________ route is not always the best
● Often, the smoothest route is more important than the quickest route
● Try to avoid ___________________________ that can cause unnecessary jarring and movement of the patient
● Give the patient a gentle trip
● Consider air transport if in ___________________________ terrain

62 Medications and Neurogenic Shock (1 of 2)
● Fluid Challenge to fill vascular space
  - Isotonic Solution (____________ or NS)
  - At least __________ ml initially for an adult
  - Monitor response and repeat as needed to maintain systolic BP
● PASG
  - ___________________________
  - Research shows no positive outcome

63 Medications and Neurogenic Shock (2 of 2)
● ___________________________ to increase BP
● Atropine to speed up heart
● ___________________________ if neurodeficit is identified
  - Reduce the body’s response to injury
  - Reduce swelling and pressure on cord
  - Administered within 1st 8 hours of injury

64 Summary
● ___________________________ is the single most important indicator for need to immobilize
• Ability to walk and move is not sufficient to rule out spinal injury
• __________________________ movement of the patient is of utmost importance
• Use IV fluids to “top off the tank” and fill __________________________ space

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